The Microblade Tradition in China: Regional Chronologies and Significance in the Transition to Neolithic

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THE MICROBLADE TRADITION IN CHINA has been considered by Smith (1974) to be a part of his Northeast Asian–Northwest American Microblade Tradition. Within China, assemblages of this tradition were first discovered in the 1920s in the northern, northwestern, and northeastern regions of the country (Chun Chen 1984; Chen and Wang 1989), and numerous archaeological sites with microblades have been found since the 1950s. To date, over two hundred archaeological assemblages and find spots with microblades have been located in China, mainly in areas of middle to high latitudes (Bettinger et al. 1994; Tong 1979; Wu 1987; Yang 1987) (Fig. 1).

The accumulation of discoveries during the past forty years has provided new information for a better understanding of this lithic tradition. We now know that it was more expansive geographically than previously thought, with sites located not only in northern and central China but also in the south and southwest. The time span of the tradition is now known to have extended from the late Pleistocene into the mid-Holocene; in part of the northern areas this tradition lasted into the historical period.

During the past four decades, studies of this topic have been conducted by Chinese scholars, and the achievements are significant. Jia (1978 : 138) has claimed that a set of implements, including wedge-shaped, conical, prismatic, cylindrical, and boat-shaped microcores as well as microblades, is typical of the tradition. Some scholars have proposed central China as the original region for the tradition (An 1992; Gai 1985, 1991; Jia et al. 1972; Yang 1987). It has also been claimed that the tradition extended to other regions of East Asia (An 1992; Chen 1983; Gai 1985; Jia 1978). A general hypothesis of three phases in the evolution of microblades—early (Upper Paleolithic), middle (Mesolithic) and later (Neolithic)—has been proposed (Gai 1985; Ge 1985). More detailed studies focused on microcore preparation have led to another hypothesis of two phases of microblade technology within the Upper Paleolithic (Chen and Wang 1989).

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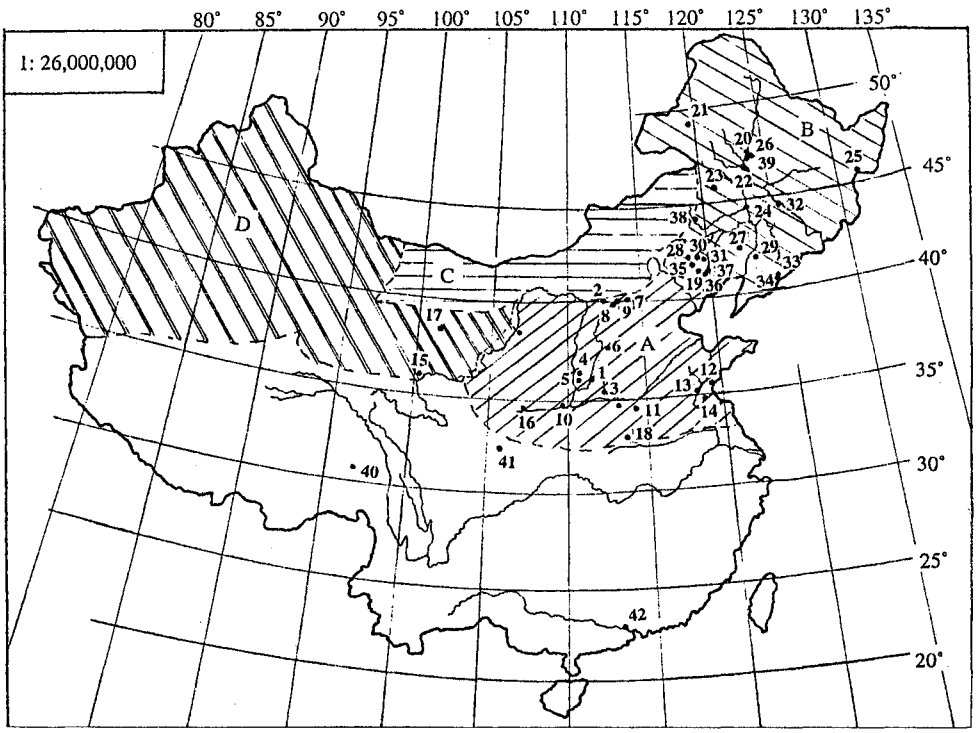

Fig. 1. Archaeological sites mentioned in the text. A: Central China; B: Northeastern China; C: Northern China; D: Northwestern China; 1: Dingcun 77:01; 2: Shiyu; 3: Xiachuan; 4: Shizitan; 5: Xueguan; 6: Dafa; 7: Youfang; 8: Jinjitan; 9: Hutouliang; 10: Shayuan; 11: Linjin; 12: Malingshan; 13: Lianyungang; 14: Fenghuangling; 15: Layihai; 16: Dadiwan; 17: Yuanyangchi; 18: Wuyang Dagang; 19: Xibajianfang; 20: Daxingtun; 21: Haila'er; 22: Dabusu; 23: Gacha; 24: Yaojinzi; 25: Xinkailiu; 26: Tengjiagang; 27: Chahai; 28: Xinglongwa; 29: Xinle; 30: Zhaobaogou; 31: Xiaoshan; 32: Xiduanlianshan; 33: Dagang; 34: Houwa; 35: Xishuiquan; 36: Nuiheliang; 37: Dongshanzui; 38: Fuhegoumen; 39: Angangxi; 40: Chengdukaruo; 41: Zhongzipu; 42: Xiqiaoshan.

The early stage, represented by Xiachuan, was characterized by conical cores and small boat-shaped cores; wedge-shaped cores were rare and the technique for platform preparation was simple (Chen and Wang 1989). The later stage, represented by Xueguan and Hutouliang, was characterized by the increasing dominance of wedge-shaped cores and the more sophisticated techniques of platform preparation (Chen and Wang 1989). Regional aspects of the tradition in central China and Xinjiang have also been synthesized (Wu 1987; Yang 1987), and the significance of microblades in the overall history of lithic technology has recently been discussed (Yu 1995). Some questions related to the microblade tradition have not yet been fully explored, however. First and foremost, the concept of this lithic tradition in China, commonly called "microlithic," is still ambiguous. Second, although archaeological discoveries have documented that the microblade tradition in China existed for more than 20,000 years, co-existing with various other lithic technologies (An 1981; Gai 1985), the temporal variations within this tradition and the interrelationships of microblade and nonmicroblade traditions (including ground stone tools) have received little attention. Major investiga-

tions seem to have concentrated on the techno-typological aspects of microcores. Finally, the significance of the occurrence of microblades in association with nonmicroblade lithic assemblages in the transitional period from hunting and gathering to cultivation in the early Holocene seems insufficiently stressed.

In this paper, existing definitions of the microblade tradition will be discussed and clarified. Major microblade assemblages in different regions, together with temporal variations and associations with other nonmicroblade traditions, will be discussed. Further, the subsistence strategies that might have corresponded with the lithic assemblages in each area will be analyzed. Finally, the significance of microblades in the transition from foraging to agriculture will be discussed.

CONCEPTS AND DEFINITIONS

Microblades in China were first discovered and studied during the 1920s by scholars such as S. Hedin and Teilhard de Chardin (Chen and Wang 1989), and were given the name "microliths." Three basic definitions have been applied to the tradition. The first states that "microlithic industries consist of small scrapers, points, and arrowheads, with long and thin blades being the salient characteristic" (Jia 1978 : 138). According to this definition, not only microblades but also other flaked tools are classified as microliths. By including scrapers, points, small projectile points, burins, and other flaked artifacts as microliths, however, this definition fails to acknowledge the distinction between microblades and small flake tools in China. The roots of the latter can be traced back into the earliest lithic industries in China, e.g., Donggutuo (Jia 1989), and continued well into the Neolithic.

Another definition states that "microliths equate with stone tools retouched by pressure flaking," leading to a further suggestion of using the term "pressure flaked tools" instead of "microlithic" (Yang et al. 1979 : 92). Such a definition clearly has no place in maintaining microliths as a distinct technological category.

A third definition claims that only microcores, microblades and tools made from microblades, plus microcore-rejuvenation flakes should be classified as microliths (An 1978 : 306–307). This definition is less ambiguous than the previous two; only microblades and microcores as well as the debitage of production can be relevant to the concept of a microblade tradition. More importantly, this definition clearly distinguishes microblades from other concurrent lithic industries in China, thus enabling us to identify the emergence, development, and decline of this lithic tradition, as well as its cultural significance in the transition from Paleolithic to Neolithic in China. Thus, An's definition will be applied in this paper. Tools made on microblades, such as points and scrapers, will be called "micropoints" and "microscrapers" to distinguish them from nonmicroblade points and scrapers. All tools made of small flakes will be classified as small flake tools.

Microblades in China are usually less than 5 cm in length, 1 cm in width, and 0.5 cm in thickness, with triangular or trapezoid cross sections (Gai 1985 : 227). The platforms of the microcores were often prepared before microblade detachment, and it has been claimed that various techniques were involved in platform preparation (Chun Chen 1984; Gai 1991).

Microblades in China are often found in association with tools made from small flakes. These small flake tools consist of various kinds of scrapers, points,

burins, and denticulate flakes (Shi 1989). Retouching on such flake tools was carried out by direct flaking in the Early and Middle Paleolithic, but pressure flaking was employed from the Upper Paleolithic onward, as demonstrated by very flat, invasive, and well-arranged flutes, which sometimes bifacially cover the whole surface of the artifact (e.g., some of the arrowheads and points found in Xiachuan). The size of these small flake tools varies but is normally under 6 cm in maximum dimension (Zhang 1989). As mentioned above, some Chinese scholars classify these small flakes as part of the microlithic tradition due to their smallness.

Apart from the need for clear definition of the microblade tradition, further concerns are those of chronology and terminology. The chronological and lithic-evolutionary position of microblades is a question under debate in China, particularly for those dated at the end of the Pleistocene. These assemblages have been referred to as Upper Paleolithic or Mesolithic by various scholars who hold contrasting opinions on the existence of a Mesolithic in China. The debate about China's Mesolithic is ongoing; even the definition of the Mesolithic in the Chinese context is not clear (e.g., Chen 1990; Huang 1987; Zhang 1984; Zhang 1988). Further, microblades have been found associated with pottery and ground stone tools, and even bronze items in north China (Tong 1979; Yang 1987). This lithic tradition did not exist only in the Stone Age (Paleolithic or Neolithic) in the Chinese context. To avoid conceptual ambiguities, geochronological terms such as "upper Pleistocene" and "Holocene" will be used in the following discussion wherever possible.

According to the geochronological divisions generally accepted in China, the upper Pleistocene is a period from roughly 140,000–10,000 B.P., covering the last cycle of glaciation (Jia and Wang 1985). The early Holocene refers to the period from 10,000 to 8000 B.P.; the middle Holocene from 8000 to 3000 B.P., and the later Holocene from 3000 B.P. to the present (Zhao 1987).

THE MICROBLADE TRADITION IN CHINA BY REGION

Region 1. Central China

This central area refers to the middle and lower valley of the Yellow River, extending approximately between latitudes 32°30′ and 38°N, and longitudes 105° and 122°E (Fig. 1). The paleoenvironment of this region can be reconstructed based upon pollen analysis, which indicates a cold climate spanning the last glacial maximum (c. 20,000–12,000 B.P.), with yearly average temperatures dropping to about 4.5°C, approximately 8–9°C below those of the present (Li 1987). Coniferous forest and cold steppe vegetation covered very large areas during this period. Animals found during the last glacial maximum period belonged to the *Elaphus-ultima* fauna, including species such as spotted hyena (*Crocuta ultima*), giant deer (*Megaloceros ordosianus*), Wansjocki's buffalo (*Bubalus wansjocki*), aurochs (*Bos primigenius*), racoon dog (*Nyctereutes procyonoides*), wild horse (*Equus przewalskyi*), wild Asiatic ass (*Equus hemionus*), spotted deer (*Cervus hortulorum*), red deer (*Cervus elaphus*), and Przewalskyi's gazelle (*Gazella przewalskyi*). This fauna is well represented in the animal remains from the Xujiayao and Shiyu sites in the middle valley of the Yellow River (Huang 1989). In the early Holocene, between 10,000 and 8000 B.P., the temperature rose to a mean annual tempera-

ture of 10–11°C, slightly higher than that of the present (Zhao 1987). A mixture of coniferous and deciduous forest and steppe became predominant (Li 1987; Zhao 1987). Various deer were still found in the early Holocene in central China, but some species such as spotted hyena, giant deer, and red deer were extinct.

Phase I. The Emergence and Florescence of the Microblade Tradition in Central China — It has been claimed that the earliest microcores and microblades in China have been found in this region, from locality 77:01 in Dingcun, Shanxi province, dated at 26,450 ± 590 B.P. (Wang and Tao 1993) (Table 1). Some scholars are skeptical about this date (An 1984; Zhang 1990). Another archaeological assemblage from a Xiachuan is much more informative, and the date of this assemblage seems more convincing. Located in Shanxi province, the Xiachuan assemblage is represented by 16 find places in a small basin called Qinshui. Excavations during the 1970s yielded thousands of implements, mainly from two layers. Heavy-duty stone tools were found in the lower layer and radiocarbon dated to 36,200 ± 2500 B.P., whereas flakes, blades, and microblades were recovered from the upper layer and dated from 23,900 ± 1000 to 13,900 ± 300 B.P. (Table 1). Typical microblade implements, including microcores ranging from prismatic, conical, semi-conical, and boat-shaped to funnel-shaped (Fig. 2), and points and scrapers formed on microcores and microblades have been discovered (Chen 1996; Chen and Wang 1989; Shi 1989; Wang et al. 1978). The term "Xiachuan culture" usually refers to this lithic assemblage (Shi 1989).

The major raw materials for lithic manufacture at Xiachuan were chert and flint. Quartz and quartzite were also used, which were available in the vicinity of the site. In terms of manufacturing technology, the striking platforms of some microcores were prepared before blade detachment, while others simply had natural platforms (Fig. 2). The majority of the microblades were utilized without further trimming, but were usually truncated on both ends (Fig. 3). Similar truncated microblades have been found inserted into bone hafts forming the cutting edges of composite tool in Neolithic sites, as at Yuanyangchi in the upper valley of the Yellow River (Gansusheng Wenwudui 1974). Therefore, it has been suggested that the truncated microblades found at Xiachuan were used in the same manner (Jia 1978:137). The micropoints and microscrapers were secondarily retouched (Wang et al. 1978).

Calculating from data contained in the first Xiachuan excavation report (a final report has not been published), the proportion of microblades and microcores in the Xiachuan culture was about 22.6 percent of the total stone tool assemblage. Small flaked tools such as burins, arrowheads, drills, various scrapers, and points accounted for another 72 percent. The remainder were heavy-duty tools made from large cores and pebbles, including flakes, points, choppers, hammers, flaked adzes, and grinding slabs (based upon Wang et al. 1978). Although not predominant in the lithic assemblage overall, the microblade tradition of Xiachuan exhibits a great typological variation that no other site in China can equal. Further, the technique for making microblades suggests quite mature craftsmanship. The majority of microcores and blades were morphologically similar, indicating good control over core preparation and blade detachment.

A few sites dated to the same time or possibly later than Xiachuan and with similar assemblages have been excavated in the middle valley of the Yellow

TABLE 1. ABSOLUTE DATES OF SOME ARCHAEOLOGY ASSEMBLAGES OF THE LATE PLEISTOCENE IN CHINA

SITE	LOCATION	SAMPLE NO.	LABORATORY[a]	SAMPLE	PROVENANCE OF SAMPLE	UNCALIBRATED ^{14}C DATE (B.P.) (h.l. 5730)	UNCALIBRATED ^{14}C DATE (B.P.) (h.l. 5568)	REFERENCE
Dingcun 77:01 spot	35°56′N, 111°25′E	PV-164	Gujizhuisuo shiyanshi	Shell	Second terrace of the Fen River		26,450 ± 590	Li et al. 1987
		PV-129	Gujizhuisuo shiyanshi	Charcoal	Same as above		>40,000	Li et al. 1987
Xiachuan Spot No. 1	35°27′N, 112°2′E	ZK-638	Kaogusuo shiyanshi	Charcoal	Square 1, layer 3, 1.65 m deep	36,200 + 3500–2500		Kaogusuo 1991
		ZK-417	Kaogusuo shiyanshi	Charcoal	Square 8, layer 2	23,900 ± 1000		Kaogusuo 1991
		ZK-384	Kaogusuo shiyanshi	Soil and charcoal	Square 2–6, layer 2	21,700 ± 1000		Kaogusuo 1991
		ZK-385	Kaogusuo shiyanshi	Charcoal	Square 1, layer 2, lower section	16,400 ± 900		Kaogusuo 1991
Xiachuan shunwangpi	35°27′N, 112°2′E	ZK-634	Kaogusuo shiyanshi	Charcoal	Square 2, layer 3	19,600 ± 600		Kaogusuo 1991
		ZK-762	Kaogusuo shiyanshi	Charcoal	Square 3, layer 3, the upper section	13,900 ± 300		Kaogusuo 1991
Xiachuan Spot No. 2		ZK-393	Kaogusuo shiyanshi	Charcoal	Square 2, layer 2	20,700 ± 600		Kaogusuo 1991
Xiachuan Spot No. 3		ZK-494	Kaogusuo shiyanshi	Soil	Square 1–2, layer 2	18,375 ± 480		Kaogusuo 1991
Xiachuan Spot No. 4		ZK-497	Kaogusuo shiyanshi	Peat	Square 101–103, layer 2	18,560 ± 480		Kaogusuo 1991
Xueguan	36°27′N, 110°59′E	BK-81016	Beida kaoguxi	Charcoal	Associated with microblades	13,550 ± 150		Chen et al. 1984
Hutouliang	40°1′N, 114°9′E	PV-156	Gujizhuisuo shiyanshi	Bone	II terrace of a sandy loess layer		10,690 ± 210	Li et al. 1987
		?	The Chinese University of Hong Kong	Potsherd	The upper layer	(Thermoluminescence dated 11,870 ± 1720)		Tang 1997
Daxingtun	47°2′N, 123°53′E	PV-368	Gujizhuisuo shiyanshi	Bone	Square 1, upper layer		9460 ± 80	Li et al. 1987, Huang et al. 1984
		PV-369	Gujizhuisuo shiyanshi	Bone	Square 1, lower layer	11,800 ± 150	11,470 ± 150	Li et al. 1987, Huang et al. 1984

[a] Gujizhuisuo shiyanshi: the laboratory of the Paleovertebrate and Paleoanthropology Institute, CASS; Kaogusuo shiyanshi: the laboratory of the Institute of Archaeology CASS; Beida shiyanshi: the laboratory of the Archaeology Department of Beijing University.

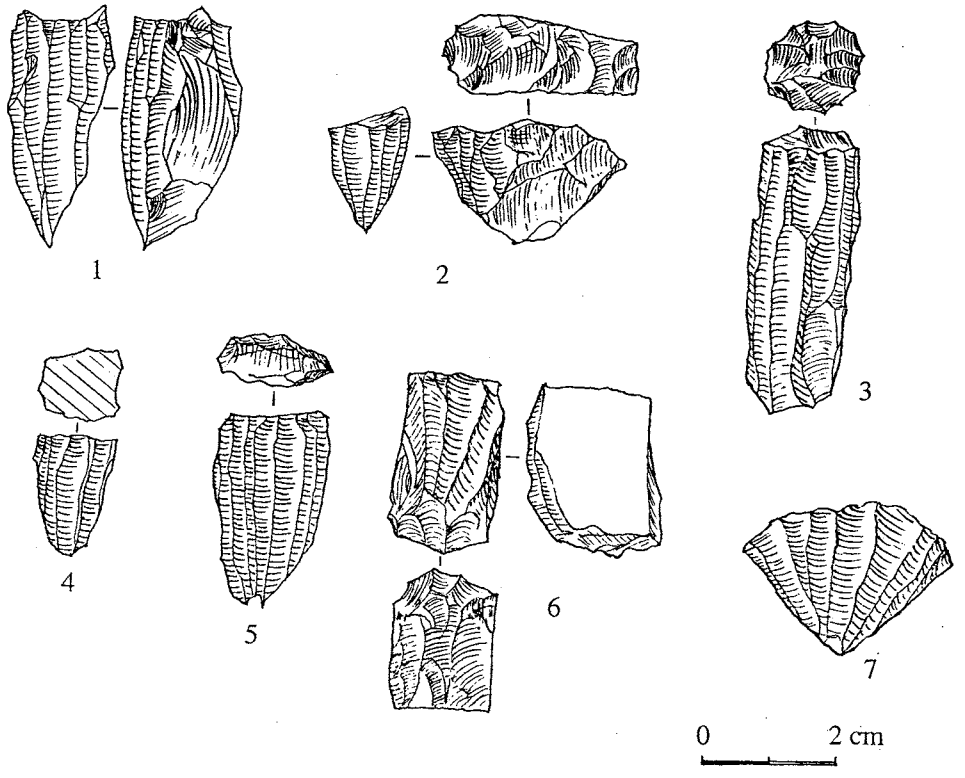

Fig. 2. Typical microcores found in China. 1: wedge-shaped core; 2: boat-shaped core; 3: prismatic core; 4: conical core; 5: semi-conical core; 6: polyhedral core; 7: funnel core (1–6 from Xiachuan, 7 from Shizitan).

River. In Shanxi province these include Shizitan (Shanxisheng Linfen Wenhuaju 1989), Xueguan (Wang et al. 1983), and Dafa (Wu et al. 1990) (Fig. 1). In the Nihewan Basin in Hebei province they include the sites of Youfang (Xie and Cheng 1989), Jinjitan (Xie and Li 1993), and Hutouliang (Gai and Wei 1977) (Fig. 1). Surface collections at Shayuan (An and Wu 1957; Banpo Bowuguan and Dali Wenhuaguan 1983) in Shaanxi province and Linjin (Zhou 1974) in Henan province have yielded similar materials (Fig. 1). Radiocarbon dates have been obtained for Xueguan (13,550 ± 150 B.P.) and Hutouliang (11,870 ± 1720 B.P.) (Table 1) (Huang 1989; Tang 1997), which place these assemblages at the end of the Pleistocene.

More sites with microblade technologies have been surveyed in the lower valley of the Yellow River, including Malingshan in Shandong province and Lianyugang and Fenghuangling in north Jiangsu province (Ge 1985) (Fig. 1). These sites have yielded abundant microblades and microcores resembling those of Xiachuan, although the degree of typological variation in these assemblages is less than at Xiachuan. Clearly, they belong to the same microblade industry. The main characteristics of this industry can be summarized as follows:

1. Major raw materials were chert and flint. Quartzite was also used but in a lesser proportion.

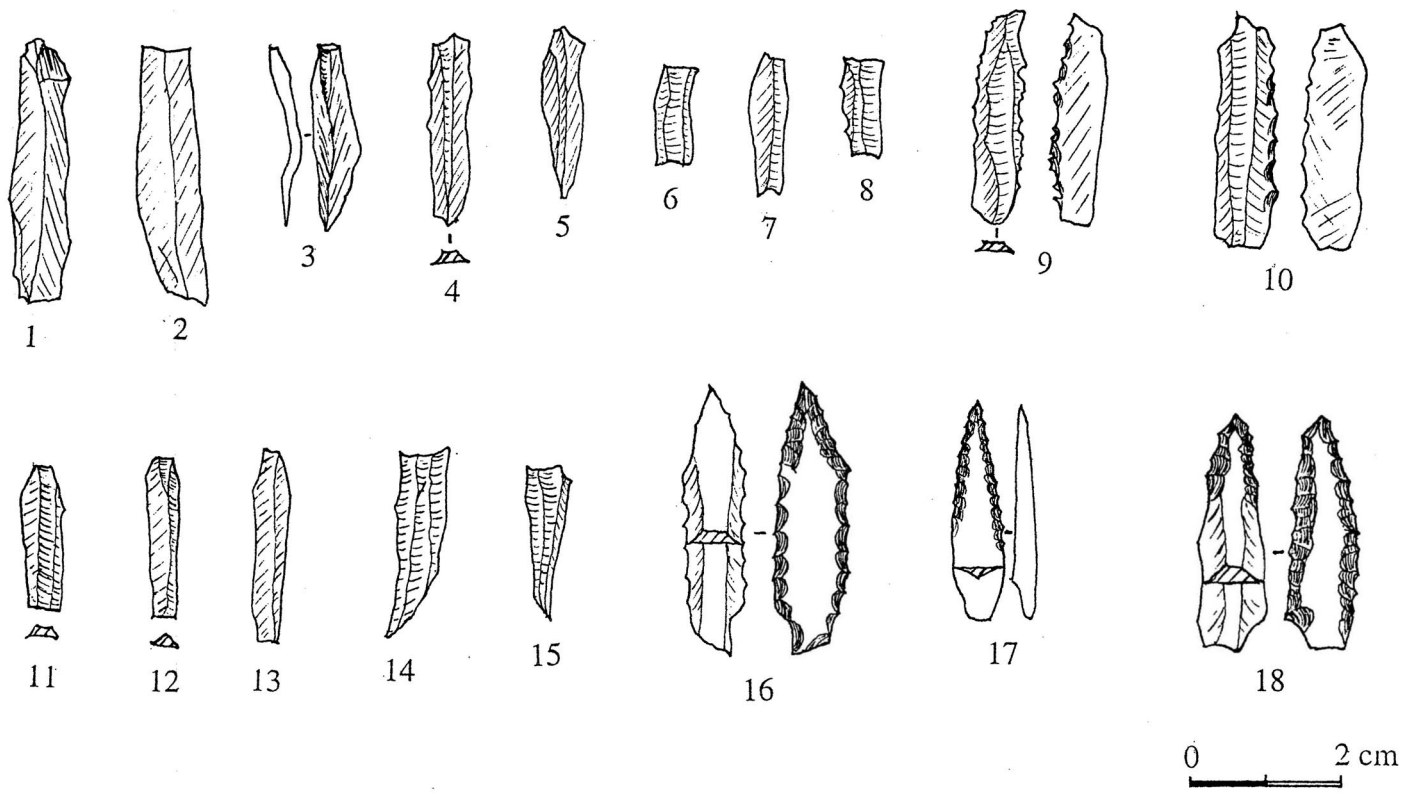

Fig. 3. Typical microblades found in China. 1–8: microblades; 9–10: microscrapers; 11–15: microblades; 16–18: microarrowheads (1–3 from Xiachuan, 4–10 from Shizitan, 11–15 from Haila'er, 16–18 from Xinle).

2. The techniques of microblade removal were generally identical over the region. According to excavation reports, indirect percussion was employed, but techniques of striking platform preparation on microcores varied. Hetao technology is said to have been employed in Hutouliang, but this technique was absent in Xiachuan (for details, see Chen 1983; Chen and Wang 1989; Gai 1991).

3. Typological variety within the microblade tradition reached a maximum soon after the emergence of this lithic tradition, exemplified in Xiachuan by the wide range of microcore and microblade types (Figs. 2 and 3), plus micropoints and microscrapers. This variation declined dramatically after the emergence of local Neolithic cultures by the eighth millennium B.P. Wedge-shaped microcores continued into the Holocene in this region, associated with fewer microblades; other microcore types were rare and microblade tools disappeared (Chende Diqu Wenguansuo 1994; Kaogusuo Henan Yidui 1983).

4. The majority of microblades were truncated after detachment and thus form rectangular "razors" for the cutting edges of composite tools, as suggested by antler and bone hafts with inserted microblades found in Neolithic assemblages (Gansusheng Wenwudui 1974; Kaogusuo Neimengdui 1985) (Fig. 3). These microblades were normally without secondary retouch.

5. Microblades of terminal Pleistocene date are normally associated with tools made on small flakes, as well as with heavier items such as chipped axes, adzes, and grinding slabs (Shanxisheng Linfen Wenhuaju 1989; J. Wang et al. 1978; X.-q. Wang et al. 1983). The last three items are the forerunners of their Neolithic counterparts. Thus, these archaeological assemblages with microblades may run alongside the transition of toolkits from Paleolithic into Neolithic. That such lithic assemblages seem to occur first in the middle valley of the Yellow River, then later in the upper and lower valleys, may also indicate lines of diffusion. It is worth noting that a site called Layihai in the upper valley of the Yellow River yielded a similar archaeological assemblage with microblades, radiocarbon dated to only around 6000 B.P. (Table 2) (Gai and Wang 1983). At this time, the middle valley had long been occupied by farmers of the Cishan and Peiligang cultures, while the pioneering Neolithic culture of Dadiwan had reached the edge of the upper valley by the eighth millennium B.P. (Gansusheng Bowuguan 1981). This suggests that hunter-gatherers and agriculturists might have both occupied regions of central China for several millennia following the commencement of the Holocene.

It seems from the toolkits, and the faunal remains yielded from sites such as Shizitan and Hutouliang, that the primary subsistence strategy associated with these microblade assemblages was a broader spectrum of hunting and gathering, especially ungulate hunting. The presence of grinding slabs and handstones signal the possibility of wild cereal exploitation, as in Kebaran and Natufian sites in west Asia. The flaked axes and adzes could have been used for forest clearance. Although no permanent settlements have been found so far, hearths were found in Hutouliang (Gai et al. 1977) and Nanmo (Chen et al. 1995).

Phase II. The Decline and Termination of the Microblade Tradition in Central China — By about the eighth millennium B.P., numerous Neolithic cultures had appeared in central China that were associated with more permanent settlements and millet or rice agriculture. The toolkits of these Neolithic sites included mainly polished

TABLE 2. ABSOLUTE DATES OF SOME ARCHAEOLOGY ASSEMBLAGES OF THE EARLY HOLOCENE IN CHINA

SITE	LOCATION	SAMPLE NO.	LABORATORY[a]	SAMPLE	PROVENIENCE OF SAMPLE	UNCALIBRATED ^{14}C DATE (B.P.) (s.l. 5730)	CALIBRATED DATE (B.P.)	REFERENCE
Layihai	35°31′N, 100°20′E	N.A.	N.A.	Bone	Second layer	6745 ± 85		Gai and Wang 1983
		PV-190	Gujizhuisuo shiyanshi	Charcoal	Second layer	5950 ± 85		Li et al. 1987
Xinkailiu	45°21′N, 132°32′E	N.A.	N.A.	Human bone	Tomb no. 5		6080 ± 130	Heilongjiang-sheng Kaogudui 1979
Tengjiagang	47°7′N, 123°49′E	PV-370	Gujizhuisuo shiyanshi	Bone	N.A.	7570 ± 85		Li et al. 1987 Yu 1991
Chahai	42°N, 121°36′E	ZK-2138	Kaogusuo shiyanshi	Charcoal	House no. 1	6925 ± 95		Kaogusuo 1991
		N.A.	N.A.	N.A.	N.A.	7360 ± 150		Liaoningsheng Kaogusuo 1994
Xinglongwa	42°25′N, 120°45′E	ZK-1389	Kaogusuo shiyanshi	Bone	House no. 10	5660 ± 170		Kaogusuo 1991
		ZK-1390	Kaogusuo shiyanshi	Charcoal	Remains of house no. 119, layer 2	6895 ± 205		Kaogusuo 1991
		ZK-1391	Kaogusuo shiyanshi	Charcoal	Remains of house no. 119, layer 3	7470 ± 115		Kaogusuo 1991
		ZK-1392	Kaogusuo shiyanshi	Charcoal	Remains of house no. 119, layer 4	7240 ± 95		Kaogusuo 1991
		ZK-1393	Kaogusuo shiyanshi	Charcoal	Remains of house no. 121, layer 2	6965 ± 95		Kaogusuo 1991
		ZK-1394	Kaogusuo shiyanshi	Charcoal	Remains of house no. 133, layer 3	5865 ± 90		Kaogusuo 1991
		ZK-2064	Kaogusuo shiyanshi	Charcoal	Remains of house no. 142, layer 1	5735 ± 85		Kaogusuo 1991

(*Continues*)

TABLE 2 *Continued.*

SITE	LOCATION	SAMPLE NO.	LABORATORY[a]	SAMPLE	PROVENIENCE OF SAMPLE	UNCALIBRATED ^{14}C DATE (B.P.) (h.l. 5730)	CALIBRATED DATE (B.P.)	REFERENCE
Xinle	41°47′N, 123°23′E	BK-78054	Beida kaoguxi	Charcoal	House no. 2	6150 ± 95		Kaogusuo 1991
		WB 79-05	Wenbaosuo shiyanshi	Charcoal	House no. 2	6335 ± 95		Kaogusuo 1991
		ZK-0267	Kaogusuo shiyanshi	Charcoal	Ash pit no. 2	6145 ± 120		Kaogusuo 1991
		ZK-0677	Kaogusuo shiyanshi	Charcoal	House no. 2	6620 ± 150		Kaogusuo 1991
Zhaobaogou	42°10′N, 120°10′E	ZK-2135	Kaogusuo shiyanshi	Charcoal	House no. 2	6210 ± 85		Kaogusuo 1991
		ZK-2136	Kaogusuo shiyanshi	Charcoal	House no. 6	6220 ± 85		Kaogusuo 1991
		ZK-2137	Kaogusuo shiyanshi	Charcoal	House no. 7	6155 ± 95		Kaogusuo 1991
Xiaoshan	42°25′N, 120°45′E	ZK-2061	Kaogusuo shiyanshi	Charcoal	Remains of house no. 2, layer 1	6150 ± 85		Kaogusuo 1991
		ZK-2062	Kaogusuo shiyanshi	Charcoal	Remains of house no. 2, layer 2	6060 ± 85		Kaogusuo 1991
Nuiheliang	41°18′N, 119°28′E	ZK-1351	Kaogusuo shiyanshi	Charcoal	I block, house no. 1	4970 ± 80		Kaogusuo 1991
		ZK-1352	Kaogusuo shiyanshi	Charcoal	I block, house no. 1	4975 ± 85		Kaogusuo 1991
		ZK-1354	Kaogusuo shiyanshi	Charcoal	II block, tomb no. 8	4605 ± 125		Kaogusuo 1991
		ZK-1355	Kaogusuo shiyanshi	Charcoal	II block ground	4995 ± 110		Kaogusuo 1991
Dongshanzui	41°21′N, 119°27′E	BK-82079	Kaogusuo shiyanshi	Charcoal	F4(2) west side	4895 ± 70		Chen et al. 1984

Zhongzipu	32°24′N, 105°48′E	ZK-2568	Kaogusuo shiyanshi	Charcoal	Square 6, layer 3	5940 ± 105	Kaogusuo 1992
		ZK-2569	Kaogusuo shiyanshi	Charcoal	Square 7, ash pit No. 2	5520 ± 100	Kaogusuo 1992
		ZK-2571	Kaogusuo shiyanshi	Charcoal	Ash pit No. 4	5225 ± 90	Kaogusuo 1992
		ZK-2566	Kaogusuo shiyanshi	Charcoal	Square 1, layer 3	3815 ± 80	Kaogusuo 1992
Xiqiaoshan	22°56′N, 112°59′E	BK-87049	Kaogusuo shiyanshi	Shell	Square 1, bottom of layer 5	6765 ± 90	Chen et al. 1994
		N-18	?	Shell	Square 1, bottom of layer 5	6120 ± 130	Zeng and Li 1988
		GSU-88-7	Zhongda shiyanshi	Shell	Square 1, bottom of layer 5	5955 ± 135	Zeng and Li 1988
		ZK-0544	Kaogusuo shiyanshi	Shell	VII(3), 0.7 m deep	5547 ± 100	Zeng and Li 1988
		ZK-0543	Kaogusuo shiyanshi	Shell	VII(2), 0.5 m deep	5050 ± 100	Zeng and Li 1988

[a] Wenbaosuo shiyanshi: the laboratory of the Institute of Relics Preservation of the National Management Bureau for Relics; Zhongda shiyanshi: the laboratory of Zhongshan University. See Table 1 for other laboratories.

stone tools, and flaked stone tools declined rapidly. Microblades remained as part of the lithic assemblages in only a few early Neolithic sites, such as Wuyang Dagang, a site of the Peiligang culture, but quantities were significantly reduced (Henansheng Wenwu Yanjiusuo 1990). This decline of microblades does not necessarily indicate a decrease in hunting and fishing activities. In fact, numerous tools for hunting or fishing made of materials other than stone have been found in Neolithic assemblages. At the famous Ban-po site, among a total of 7862 tools there were 21 bone harpoons and 282 bone arrowheads, as well as net sinkers made of pottery (Kaogusuo 1963).

It seems that in the early shift to sedentism and cultivation, hunting, gathering, and fishing continued as supplementary subsistence activities, but microblade industries were diminishing rapidly and had almost disappeared by 5000 B.P. in central China. Only in the upper valley of the Yellow River did the tradition survive longer, as in Yuanyangchi and Layihai (Gai and Wang 1983; Gansusheng Wenwudui 1974).

Discussion — The microblade tradition in central China is the earliest occurrence of this industry in China. The emergence of the tradition can be traced back at least 26,000 B.P. at Dingcun 77:01 (Wang and Tao 1993). The microblade assemblage in this region was also the most diverse in China in terms of typological variety and the quantity and quality of the implements. However, this degree of variation was reduced in assemblages of the early Holocene period. Microblades have seldom been found in association with ground stone tools in central China (Kaogusuo Henan Yidui 1983), and this is a salient difference from the situation in other areas of China.

The florescence of microblades in central China, as exemplified by high degrees of similarity and significant proportions of microblade elements within whole lithic assemblages (e.g., 22 percent in Xiachuan, 42.1 percent in Shizitan, and 17.5 percent in Xueguan), occurred approximately between 16,000 and 11,000 B.P. They became insignificant after 8000 B.P. when agriculture seems to have become the primary subsistence strategy. The crucial period for the transition from hunting and gathering to agriculture in China lies between 11,000 and 8,000 B.P., but unfortunately archaeological data for this period are scanty. Recent studies in Nihewan have revealed a sequence of deposits from the end of the Pleistocene into the early Holocene, yielding microblades throughout (Xie 1991). In the Wuyang Dagang site in Henan province, a layer containing microblades was located directly under an assemblage of the Peiligang culture (Zhang and Li 1996). According to these discoveries, the lithic assemblages consisting of microblades, small flakes, and heavy-duty stone tools could have served as direct precursors for the early Holocene lithic assemblages of the region.

Region 2. North China

In this article, north China refers to the northern, northwestern, and northeastern parts of China, approximately between latitudes 38° and 50°N, encompassing (from east to west) the administrative districts of Heilongjiang, Jilin, Liaoning, Inner Mongolia, Ningxia, Xinjiang, and Gansu (Fig. 1). This vast region is largely a desert and steppe environment today, with forest in the northern part of northeastern China where pastoralism, fishing, and hunting were the main eco-

nomic strategies up to the beginning of this century. Today, agriculture is the primary subsistence strategy in the southern part of this area. The rest is occupied mainly by pastoralists.

According to pollen analysis, at the end of the Pleistocene the region contained a mixed coniferous and deciduous forest, indicating a climate slightly cooler than the present, but still moist (Li 1987). The dominant fauna in this region before 11,000 B.P. consisted of mammoth (*Mammuthus primigenius*), woolly rhinoceros (*Coelodonta antiquitatis*), roe deer (*Capreolus sp.*), spotted hyena (*Crocuta ultima*), tiger (*Panthera tigris*), and ox (*Bos sp.*) (Qi 1989). Both pollen and faunal data indicate a landscape of steppe and/or forest in the east and desert in the west, similar to the present. In the early Holocene the climate became moister and slightly warmer, as indicated by the extinction of the *Mammuthus* and *Coelodonta* species (Qi 1989). It is in these steppe and desert areas that microblades have been commonly discovered, where their persistence into the middle and late Holocene indicates that this lithic tradition was associated mainly with hunting and gathering activities.

More than one hundred excavated assemblages and find spots with microblade implements are widely spread over this area, ranging from the prehistoric to the historic periods (Tong 1979) (Fig. 4). Yang (1987) has claimed that microblades were found associated with bronze items in Xinjiang. This survival of microblades into such recent times is unusual in Chinese context. But it should be noted that some of these so-called "microblades" found in historic sites, such as those claimed to have been found with pottery of the Liao Dynasty (A.D. 916–1125) (Jia 1978 : 141), are in fact tools made from flakes much larger than microblades, and have been retouched by pressure flaking. Thus, microblades in historic

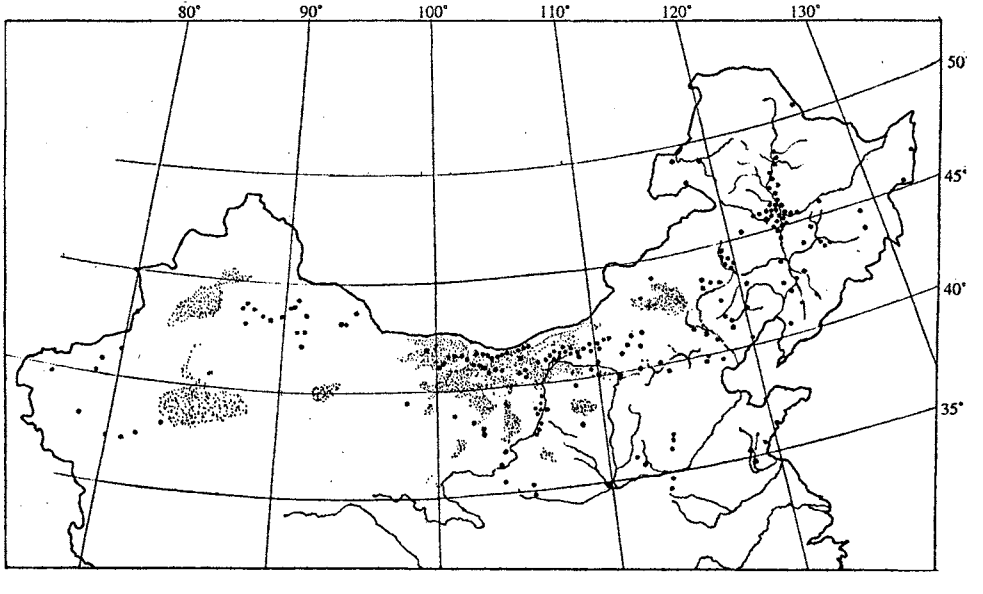

Fig. 4. Microblade find spots in north China (after Tong 1979, updated). Dots indicate microblade find spots; speckled areas indicate desert.

sites may be viewed as a minor aspect of these toolkits. In general, the microblade tradition in north China can be divided into three stages: emergence, florescence, and decline.

Phase I: The Emergence of the Microblade Tradition in North China — Only two sites with reliable strata belong to an early stage. The first, Xibajianfang in Liaoning province, was excavated in 1972, and 38 lithic artifacts including two microblades were found in a layer of sandy soil. Within the mammal fauna, aurochs (*Bos primigenius*) was the only extinct species, suggesting possibly a terminal Pleistocene date (Liaoningsheng Bowuguan 1973). The second site, Daxingtun in Heilongjiang province, was excavated in 1982; 68 stone artifacts including one prismatic microcore and 14 truncated microblades were found in a late Pleistocene stratum. The raw materials of these artifacts were mainly chalcedony, agate, and chert. It is claimed that indirect percussion was probably used for the microblades, while direct percussion was the main technique for flaking and retouching for other lithic implements. The excavators state that some microblades were truncated on both ends, possibly for inserting into composite tools (Huang et al. 1984). A single radiocarbon sample dated to 11,800 ± 150 B.P. (Table 1) is from this stratum, corresponding with the stratigraphic and faunal data, suggesting a terminal Pleistocene date (Huang et al. 1984).

Phase II. The Florescence of the Microblade Tradition in North China — There are two subdivisions within the phase of florescence. The earlier has been described as "Mesolithic" by An (1978) and occurred at about 10,000 B.P. The latter occurred from the early to middle Holocene with pottery in association.

The earlier stage is best represented by two assemblages, in terms of the advanced levels of technique and variety of tools they demonstrate. Although one is from an excavated context and the other is a surface collection, and both lack absolute dating, their chronological positions can be assumed by cross-dating with similar discoveries from excavations in central China (e.g., the Xiachuan culture). The first site is Haila'er, located in a small basin in Heilongjiang province. This site was found in the early 1950s and surveyed in the 1970s. Sixteen localities were found, the majority of which yielded only stone artifacts from a layer of dark-red soil, while pottery fragments were found in other localities. No original deposit could be identified as sand movement has completely disturbed the stratigraphy. However, abundant lithic implements were discovered. The microblade tradition was exemplified by various boat-shaped, prismatic, and conical cores, long and thin blades, as well as micropoints made from blades. The nonmicroblade lithic tradition was represented by a variety of flaked scrapers, burins, four bifaced points, a few pebble tools, and two flaked axes (An 1978). Clearly, most of the typical microblade forms in China occur in this site, and they make up 42 percent of the lithic assemblage (calculation based on An 1978). Although no radiocarbon dates are available, the researcher suggests a date of 10,000 B.P. or slightly later (An 1978 : 304).

Another site, Dabusu in Jilin province, was excavated in 1985, and 486 stone tools were recovered from a paleosol layer, including four microcores, 121 microblades, 110 flakes, eight flaked tools, one grinding stone slab, and 242 pieces of debitage (Dong 1989). The discovery of debitage suggests that this site might have been a temporary spot for stone tool manufacturing. Faunal remains were

found but not abundant. The researcher also suggests a date of about 10,000 B.P. (Dong 1989), contemporary with Haila'er. A similar discovery during a surface survey was also made in another site called Gacha in Inner Mongolia (Jilin Kaogudui 1983).

In summary, these assemblages indicate the following characteristics:

1. The lithic assemblage consisted of microblades, small flakes, and pebble tools.

2. The proportions of small flake tools are relatively high, from about 48 percent in Dabusu to 79 percent in Gacha. Microblades account for 9–51 percent in these assemblages. Pebble tools are infrequent, only 0.8 percent in Haila'er, 0.4 percent in Dabusu, but 12 percent in Gacha (debitage of Dabusu excluded in calculations).

3. Flint and chert were the main raw materials used for small flakes and microblades. The striking platforms of the microcores were prepared before flaking; indirect percussion was the main method for flaking and pressure flaking was used in retouching.

4. The microblades exhibited a high degree of typological variety in Haila'er, where five types of microcores and four types of microblades were found. Three types of microcores were found in Gacha and two in Dabusu (An 1978; Dong 1989).

5. Flaked axes were found both in Haila'er and Gacha, flaked adzes and knives were found in Gacha, while a grinding slab was found in Dabusu. These tools are the forerunners of their Neolithic counterparts and have a chronological significance in being a transitional assemblage from the late Pleistocene into the Holocene.

The later stage of florescence, from c. 7500 to 5000 B.P., can be illustrated by numerous archaeological assemblages with microblades, usually associated with pottery and ground stone tools. These assemblages can be further divided into two groups, representing different economic subsistence strategies.

Group 1 sites represent hunting and gathering cultures of this region beyond the range of agriculture, and are mainly distributed over the Nun River plain in the northernmost part of China, on the steppe to the east of the Daxing'anling mountains, and in some parts of Inner Mongolia, Ningxia, Gansu, and Xinjiang (Fig. 4). Most of these find places have been only surveyed. Among excavated sites, Yaojinzi and Xinkailiu are two of the most important (Fig. 1).

Both sites are lacustrine settlements. Seven dwellings of square shape, one ash pit, and two human burials were found in Yaojinzi. Burials and ten storage pits containing layers of fish bones were found in Xinkailiu. The large quantity of faunal remains in both sites suggest that the subsistence strategy of both sites was mainly hunting and fishing (Heilongjiangsheng Kaogudui 1979; Jilin Kaogusuo et al. 1992). In these sites microblades were quite rare, making up less than 10 percent of each lithic assemblage, and much fewer in quantity than in the Haila'er assemblage. The wedge-shaped, boat-shaped, and conical microcores were absent. On the other hand, small flake artifacts were major components of these lithic assemblages, accounting for from 51 percent to nearly 80 percent (calculations based on Heilongjiangsheng Kaogudui 1979; Jilin Kaogusuo et al. 1992).

Besides the small flakes and microblades, ground stone tools were an important

part of the toolkit, accounting for 30 percent of the total lithic assemblage in Yaojinzi and 11 percent in Xinkailiu. Types of ground tools included axes, adzes, chisels, rollers, and grinding slabs in Yaojinzi, and grinding slabs in Xinkailiu. Both sites yielded bone and antler artifacts, including bone harpoon heads, spearheads, arrowheads, fishhooks, knives, and drills (Heilongjiangsheng Kaogudui 1979; Jilin Kaogusuo et al. 1992). The upper layer of Xinkailiu was radiocarbon dated to 6080 ± 130 B.P. (Table 2) (Kaogusuo 1991). It is suggested that the date of Yaojinzi was approximately at 7000 B.P. (Jilin Kaogusuo et al. 1992).

In addition to these two excavations, numerous surveys have been undertaken since the 1950s, particularly in the Nun River valley and the desert areas of inner Mongolia (Heilongjiangsheng Bowuguan 1964, 1974; Tong 1979; Bettinger et al. 1994) (Fig. 4). Although most of these survey collections lack absolute dating, a sample taken from a survey collection in Tengjiagang, Heilongjiang province has been dated to 7570 ± 85 B.P. (Yu 1991) (Table 2). In general, the common characteristics of this group are

1. The toolkit usually consists of stone, bone, and antler artifacts. The percentage of stone tools is about 70 percent, and the bone and antler tools about 30 percent in both Xinkailiu and Yaojinzi.

2. Among the stone tools, the small flake tools were major components. Microblades were giving way to ground tools, which emerged and increased over time. Pebble tools were rare.

3. Among the small flake tools, direct percussion was still used for flaking, but pressure flaking is stated to have been broadly applied in retouching. Arrowheads and spearheads made on flakes were usually bifacially and completely retouched.

4. The number and variety of microblades were reduced over time. Boat-shaped and conical microcores are rare.

5. Pottery is often present.

It has been suggested that these archaeological assemblages represent groups of hunters, fishers, and gatherers, probably pastoralists in later stages, in the steppe and desert areas (Tong 1979). The pattern of settlement is not certain, but it has been suggested that the remains of dwellings found in Yaojinzi represented seasonal camps (Jilin Kaogusuo et al. 1992:687). Burials and storage pits further suggest the existence of at least temporary settlement. Archaeological discoveries and historic documents illustrate that the subsistence strategy of hunting, fishing, and livestock herding has been practiced into the twentieth century in part of this region. This cultural continuity is particularly salient in northeastern China. Based upon archaeological discoveries, osteologic analysis, Chinese chronicles, and ethnographic studies, Wa (1992) has proposed that such assemblages in northeastern China are ancestral to the Manchu and Hoche minorities who inhabit this region today; some of them are still hunters and fishers (Wa 1992).

Group 2 sites are mainly distributed over the small alluvial plains of Inner Mongolia and the northeastern part of China, representing an archaeological culture associated with sedentism and cultivation. The past ten years have witnessed a number of important archaeological discoveries. Hitherto, the earliest assemblages were from Chahai and Xinglongwa, radiocarbon dated to the eighth millennium B.P. (Kaogusuo Neimengdui 1992, 1997; Liaoningsheng Kaogusuo 1994) (Table 2). Other assemblages from Xinle (Shenyang Wenwu Guanli Bangongshi 1978; Xinle Bowuguan 1990), Zhaobaogou, and Xiaoshan have been

dated to the seventh to sixth millennia B.P. (Kaogusuo Neimengdui 1987, 1988) (Table 2).

Spread over part of Inner Mongolia, Liaoning, and the southern part of Jilin provinces, dwellings of rectangular shape have been found in most sites. In Chahai and Xinglongwa, small houses of 20 to 40 m^2 arranged in eleven or twelve rows were built within a protective ditch, with one large house of 100 m^2 located in the center (Kaogusuo Neimengdui 1992, 1997; Liaoningsheng Kaogusuo 1994). This pattern is comparable to that of the famous Ban-po and Jiang-zhai sites of the Yangshao culture in the middle valley of the Yellow River, but in Chahai and Xinglongwa it occurred about 1000 years earlier. The pattern clearly illustrated a well-designed, well-built prehistoric settlement, which seems to have been occupied permanently. Houses of similar shapes were also found in other sites, although the village patterns are not so clear as in these two (Kaogusuo Neimengdui 1987, 1988; Shenyang Wenwu Guanli Bangongshi 1978; Xinle Bowuguan 1990).

According to available excavation reports, most toolkits comprised predominantly chipped and polished tools for cultivation and plant processing, including hoes, spades, adzes, knives, querns, and rollers (Kaogusuo Neimengdui 1997; Liaoningsheng Kaogusuo 1994). It is particularly noticeable that small flake artifacts were absent in Chahai and Xinglongwa, and rare in other sites of this group. Microblades were found in considerable quantities in Xinglongwa, but microcores were absent (Kaogusuo Neimengdui 1997). In Chahai, only one microblade and one microcore were reported (Liaoningsheng Kaogusuo 1994). The microblade tradition is completely absent in some later sites such as Xiduanlianshan (Jilin Kaogusuo et al. 1991), Dagang (Liaoningsheng Bowuguan 1986), and Houwa (Dandongshi Wenwudui 1984), all estimated at approximately 6000 B.P. or slightly earlier. In other sites, microblades continued as part of the lithic assemblage but the proportions varied from one site to another. Microblades were rare in Zhaobaogou (Kaogusuo Neimengdui 1988), but over 140 were found in Xinle (Shenyang Wenwu Guanli Bangongshi 1978; Xinle Bowuguan 1990). A total of 2490 microblades were found in Xiaoshan, where house no. 2 alone yielded a total of 2482 (Kaogusuo Neimengdui 1987).

This variation in the occurrence of microblades may reflect different adaptations to environment at situation. While in Chahai and Xinglongwa the large sizes of the villages demonstrate sedentism and the toolkits indicate cultivation, in other sites the evidence in cultivation is not as strong and clear. Tools for hunting, fishing, and gathering, such as arrowheads and net weights, had remained abundant, illustrating that economic activities other than cultivation were still essential. Pottery was present in all sites (Kaogusuo Neimengdui 1985, 1987, 1988, 1992, 1997; Shenyang Wenwu Guanli Bangongshi 1978; Xinle Bowuguan 1990). Burials were found in Chahai and Xinglongwa (Kaogusuo Neimengdui 1992, 1997; Liaoningsheng Kaogusuo 1994). The earliest jade ornaments hitherto found in China were found both in Chahai and Xinglongwa, illustrating quite skillful workmanship. In Xinglongwa, jade ornaments, pig, pottery, microblades and other stone tools, as well as shell ornaments, were found as burial objects in one tomb, while other burials yielded fewer objects (Kaogusuo Neimengdui 1997). This may signal social and economic distinctions between members of the society, as jade was widely a symbol of privilege in ancient China. A dragon of

19.7 m in length formed by pebbles laid in the center of the village has recently been found in Chahai, and is suggested to be evidence for tribal identification (Liaoningsheng Kaogusuo 1995).

Phase III. The Decline and Termination of the Microblade Tradition in North China — The decline of microblade technology in north China, a gradual progression, commenced by roughly 5000 B.P. Many sites of mid-to-late Holocene dates have been found in this area, with important ones including Xishuquan (Kaogusuo Neimengdui 1982), Nuiheliang, Dongshanzui (Guo and Zhang 1984), and Fuhegoumen (Kaogusuo Neimengdui 1964). Radiocarbon dates for Dongshanzui and Nuiheliang are around 5000 B.P. (Table 2). In the lithic assemblages in these sites, it is notable that polished stone tools became increasingly dominant, while microblades declined in both quantity and variety (Kaogusuo 1984). Nevertheless, microblades survived through the whole prehistoric period in this region. As mentioned above, it has been claimed that microblades were found with bronzed items in Xinjiang (Yang 1987).

Discussion — In summary, the microblade tradition in north China appeared at the end of the Pleistocene, matured and spread during the early Holocene, and declined after 5000 B.P. Microblades occurred together with small flakes at the end of the Pleistocene. The ground tools, bone, and antler tools were added roughly from the eighth millennium B.P. As discussed, the proportions of microblades were relatively low in the toolkits of the sedentary and cultivating groups compared with the hunting and gathering groups. In the cultivating group, microblades occurred with polished and/or chipped heavy stone tools, such as hoes and adzes. In the fishing and hunting group, microblades accompanied small flakes, bone, and antler tools, with characteristic forms including lithic spearheads and arrowheads, as well as arrowheads and harpoon heads made of organic materials.

The technology for manufacturing microblades was identical within this region. Although raw materials varied according to the natural resources available, cryptocrystalline rocks such as flint, chert, chalcedony, jade, and agate were the most popular. The technology was homogenous: direct percussion was used for flaking and retouching in the early florescent phase, while indirect percussion and pressure flaking were employed from the later florescent phase onward. Manufacturing skills reached their highest levels in the latter phase, as exemplified by delicately retouched triangular and leaf-shaped arrowheads (as found in Xinle). Such skilled retouching was applied not only to the microblades, but also to tools of the nonmicroblade tradition. Large flakes were also bifacially retouched by pressure flaking, especially among the noncultivation assemblages such as those from Xinkailiu, Yaojinzi, and Angangxi (Heilongjiangsheng Kaogudui 1979; Jilin Kaogusuo et al. 1992; Liang 1932). On the contrary, these skillfully retouched microblades and small flakes were much less popular in the cultivator assemblages from sites such as Chahai and Xinglongwa. In northeastern China, the homogeneity of the microblade technology is accompanied by widespread resemblance in the early pottery, particularly in the large handmade vessels with sand tempers, and zigzag incised decoration. Interestingly, similar decorative patterns occur in the pottery of the Peiligang culture in central China. Whether this implies that the microblade assemblages in north China are derived from those of the central region (Yan 1979) is still a question under debate.

An important characteristic of the cultural sequence in this region is the rapid spread of microblades, in association with other cultural components, after their initial appearance. According to my literature search, at the beginning of the Holocene only a few assemblages with microblades were present; but from the eighth millennium B.P. onward they spread throughout the region during about one millennium. More than a dozen assemblages with radiocarbon dates between 7000 and 6000 B.P. have been excavated, and hundreds of undated localities have been found with similar cultural components (Tong 1979) (Fig. 4). In the Angangxi area alone there were at least 26 localities with microblades (Heilongjiangsheng Bowuguan 1974), and in the Nun River valley over one hundred spots have been discovered, with a radiocarbon date of 7360 ± 85 B.P. from a Tengjiagang locality (Heilongjiangsheng Bowuguan 1964) (Fig. 4, Table 2). The density of sites at which microblades have been found in these regions is greater than anywhere in central China. This does not necessarily indicate a denser population in the north at this time, however, since these sites were contemporary with many much larger Neolithic sites in central China where microblades had already disappeared. Further, it is possible that several localities might have been occupied by one group of hunters and gatherers during their seasonal movements. What this wide spread of microblades suggests is a rapid expansion of human activities into northern latitudes after the beginning of the Holocene.

Region 3. South and Southwest China

The archaeological data for the microblade tradition in this area are sporadic. A few sites with microblades have been found in southwest China, especially in Tibet, where several assemblages are said to be of Mesolithic to Neolithic culture (An et al. 1979; Dai 1972). The most important discovery in Tibet is the site of Chengdukaruo, claimed to be a sedentary village dated to the fifth and fourth millennia B.P. (Table 2). Chengdukaruo was excavated in the early 1980s, and microblades were found as part of the toolkit (Xizang Wenguanhui 1985). Surface discoveries have also been made in Yunnan province (Kaogusuo 1984). In 1991, a large site called Zhongzipu in Sichuan province was discovered and excavated. Typical microblades and microcores were found in association with hearths, storage pits, and pottery. A few radiocarbon dates have been obtained for Zhongzipu, ranging from 5940 ± 105 to 3815 ± 80 B.P. (Kaogusuo 1992) (Table 2). The discoverers of Zhongzipu claim that the site was a workshop for the production of microblades by indirect percussion (Kaogusuo Sichuandui 1991).

Only one site with microblades has been found so far in south China. Located near Guangzhou in Guangdong province, the site complex of Xiqiaoshan has produced numerous workshop sites for microblades and ground shouldered axes and adzes (Zeng 1981). After excavation in 1987, it became clear that the microblades chronologically preceded the shouldered tools (Zeng and Li 1988). Flint was the main raw material for the microblades, and felsite was quarried to make the ground tools. Radiocarbon dates for the microblades range from 6765 ± 90 to 5050 ± 100 B.P. (Zeng and Li 1988) (Table 2).

The absence of microblade industries so far in the rest of southern China is a little puzzling. Are there archaeological assemblages with microblades not yet discovered? Or were microblades produced for only a short time in an area where a

pebble and large-flake tool industry dominated? Do the microblade sites represent population incursions into southern China? At present, such questions can't easily be answered.

Yet all the microblades found in southern China are identical in terms of typology, technology, and morphology to those of central China, except for a type of fan-shaped microcore with a handle from Xiqiaoshan. Based upon this similarity some scholars assume cultural diffusion from central China, via the southwest, to southern China (i.e., Jia 1978 : 143). But this assumption has been challenged on the grounds of the distances involved, with a "vacant" area in between (Kaogusuo Sichuandui 1991) (Fig. 1). Another factor that casts doubt on the diffusion hypothesis is that, so far, the dates for microblades in southwest China are later than those in south China (e.g., Zhongzipu is later than Xiqiaoshan).

SUMMARY AND DISCUSSION

According to archaeological data, the time span of the microblade tradition varied in each region. In central China it lasted mainly from the late Pleistocene (16,000 B.P. in Xiachuan) into the early Holocene (roughly 8000 B.P.), but in north China the tradition persisted into the historic period. Geographically, the archaeological assemblages with microblades in China have been found mainly between latitudes 33° and 50°N, but are sporadic between latitudes 20° and 33°N. This distribution encompasses desert, steppe, and forest areas, and spans cool-temperate, temperate, and subtropical zones. Culturally, microblades were part of the toolkits for various human subsistence strategies, such as hunting, gathering, and fishing. But it should be noticed that microblades are also found in archaeological assemblages that represent cereal cultivation, such as those in Xinglongwa and Shawoli (Peiligang culture). In central China, the presence of microblades with small flakes and pebble tools in the late Pleistocene suggests a broader spectrum of foraging activities, while the decline of microblades was associated with the emergence of agriculture. The significance of microblades in central China is that this tradition is a hallmark of local lithic industry during the transitional period from foraging to agriculture.

Many Chinese scholars agree, explicitly or implicitly, that microblades in China were produced by indirect percussion (Chun Chen 1984, 1991; Yu 1995). It is claimed that microblades produced by indirect percussion are characterized by flat bulbs of force, and sometimes invisible points of impact (Jia 1978). Also, they tend to be similar in shape and size (Jia 1978). Morlan (1978) has also suggested that North American microblades were detached by indirect percussion and pressure flaking, based upon experimental evidence.

However, experiments at blade detachment using direct percussion also have been conducted. Chen (1991) used antler hammers to produced microblades by direct percussion, but he states that the results were not satisfactory (Chen 1991). Another experiment was successfully conducted by Liu (1991). The experiment shows that microblades produced by using hard hammers of stone are characterized by varying sizes, convex bulbs of force, often with errailure scars, and clearly visible points of impact; but microblades produced by using soft hammers (made of bone or antler) are characterized by similar sizes, small and flat bulbs

without erraliure scars, and invisible or unclear points of battering (Liu 1991). She further compared several small blades found at Shiyu, Xiaonanhai, and Nihewan with the blades produced by her experiments and suggested that the blades from Xiaonanhai might have been produced by soft hammers, but the others were likely to have been produced by hard hammers (Liu 1991). But it should be noticed that the stone blades from these three sites are not microblades in real terms. They were bigger, thicker, and wider than those found in Xiachuan, Xueguan, and Hutouliang.

According to Sanger (1968), microcore striking platforms were usually prepared before the removal of microblades (Sanger 1968). Liu's experiment further supported the necessity of preparing cores before blade detachment (Liu 1991). Retouching of the microblades was carried out using pressure flaking, as illustrated by invasive and flat scars on the surface of some blades (Xinle Bowuguan 1990). However, secondary retouching was not commonly applied to microblades in China, and edge damage on most is derived purely from use.

Raw materials for microblades varied depending on local resources, but flint and chert were the major ones. Other commonly used materials included agate, jade, chalcedony, and occasionally quartzite. The sizes of major implement classes varied, but a length under 5 cm can generally be taken as a guide. According to my literature research, most complete microblades vary between 2.5 and 4.5 cm in length, between 0.3 and 0.9 cm in width, and between 0.1 and 0.4 cm in thickness (based upon Gai 1977; Wang et al. 1978, 1983; Wu et al. 1990; and other archaeological reports).

The primary functions of microblades were to form the points or cutting edges of wooden or bone artifacts, as part of composite tools (Bordaz 1970). This has been shown by the discovery of microblades inserted into bone hafts in Neolithic sites of Yuanyangchi and Xinglongwa (Gansusheng Wenwudui 1974; Kaogusuo Neimengdui 1985, 1997). Some microblades were made into micropoints and microscrapers and were probably also used directly, as independent tools.

According to archaeological data, the florescence of the microblade tradition occurred at the beginning of the Holocene in north China, but at the end of the Pleistocene in central China. On present evidence, the florescence in central China, represented by the Xiachuan culture (16,000–13,000 B.P.), is a few thousand years earlier than the florescence in the north, represented by Haila'er at about 10,000 B.P. or slightly later. But it is quite clear that the microblade tradition in both areas flourished in association with similar lithic assemblages of small flakes and pebble tools.

Some Chinese scholars have argued that microblades were typical tools of the Neolithic in north China (Tong 1979). This conclusion is open to debate. First, the term "Neolithic" in the Chinese context should only be used for archaeological assemblages associated with sedentism, cultivation, ground tools, and pottery. Hunting, gathering, and fishing groups should not be classified as Neolithic, even if they did use pottery and ground stone tools beyond the range of cultivation in north China. Second, the use of the ambiguous term "microlithic," which in the Chinese context often refers to an assemblage consisting of small flakes, long blades, and even large flakes retouched by pressure flaking, incorrectly enlarges the distribution of microblades. If one carefully examines the lithic assemblages in northeastern China, it becomes clear that the florescence of

microblades occurred not in the period with ground tools and pottery, but in the period with small flakes and pebble tools (e.g., Haila'er and Dabusu). Microblades were not dominant in the archaeological assemblages of sedentism and cultivation (e.g., Chahai and Xinglongwa). Therefore, microblades should not be seen as typical tools of the Neolithic culture at least in northeastern China, but rather as a significant component in cultural assemblages during the transitional period from the Pleistocene to the Holocene.

In order to study the development of the microblade tradition, it is also necessary to evaluate the significance of this tradition in terms of its quantity and quality within lithic assemblages. If the quantity of microblade implements, including microcores, microblades, and tools made from microblades, account for over 15 percent of a whole lithic toolkit, then its presence might be considered significant (debitage should be excluded in this calculation). According to published reports, microblade implements account for about 20 percent of all lithics in Xiachuan (Wang et al. 1978), about 18 percent in Xueguan (Wang et al. 1983), about 42 percent in Shizitan (Shanxisheng Linfen Wenhuaju 1989), 35 percent (first survey, An and Wu 1957) and 21 percent (second survey, Ban-po Bowuguan and Dali Wenhuaguan 1983) in Shayuan, and 15 percent in Youfang (Xie and Cheng 1989).

There are, of course, many other factors that would have affected the proportion of microblades within an archaeological assemblage, including prehistoric human behavior relating to lithic tool discard, the taphonomic environment of the cultural deposit, and the method of collection (i.e., excavated or surface collected), even the experiences and skills of the collectors. Therefore the quality of microblades should be another important attribute. "Quality" refers to the workmanship of the microblades, which includes the techniques of microcore platform preparation, microblade detachment, and retouching; it also refers to the variety of microblades and microcores. The combination of quantity and quality should provide a yardstick to indicate the significance of microblades within a given archaeological assemblage. Archaeological assemblages with insignificant microblade proportions should not be labelled as "microlithic." This labelling has happened too often, particularly in north China. As a consequence, the distribution of the 'microlithic' has been overstated.

The lithic tradition that succeeded the microblade tradition is not clear. Microblades disappeared after the emergence of agriculture, particularly in central China. A few microblades are still found in some Neolithic sites of the Peiligang culture, such as Shawoli in Henan province, central China (Kaogusuo Henan Yidui 1983), indicating perhaps a local continuity in cultural evolution.

There are, of course, problems of origin that remain unsolved. Based upon lithic analysis of the Shiyu assemblage in central China, it was proposed in the 1970s that the microblade tradition evolved from the small flake tradition (Jia 1978). However, Shi (1989) has argued that the microblade industry originated from the not-so-small flake industry in the lower stratum of Xiachuan, demonstrated by the continuity of flake/blade detachment techniques (Shi 1989). Zhang (1990) suggested that "in general, the long blade industry is the ancestor of the microblade industry" (Zhang 1990 : 325). The issue of the origin of microblades in China is still open for debate.

Other questions involve the function of microblade tools. In other parts of the

world, microliths were used as tools in hunting and gathering, particularly to make arrowheads for effective hunting (Rozoy 1985). This conclusion seems applicable to the geometric microliths found in Europe and the Middle East. But according to recent analysis of the microliths from Beidha in Jordan, nongeometric microliths can also be used for cereal cutting (Byrd 1989). Morphologically, these nongeometric microliths look quite like the microblades in China. This observation may stimulate rethinking on the function of the Chinese microblades, especially as tools for cereal harvesting.

It is striking that, in central China, microblades were abandoned after the emergence of agriculture even though hunting, fishing, and gathering were still being practiced. Does this indicate that microblades were no longer popular as tools for hunting and gathering, or did the nature of hunting and gathering activities alter away from the situation prior to the emergence of agriculture? Current archaeological data cannot provide satisfactory answers for these questions.

It must be admitted that archaeological data on the microblade tradition in China are far from adequate, and that further study is much needed to answer the above questions. This paper is only a preliminary discussion of a number of important matters. It is to be hoped that further discoveries will shed more light on questions that remain.

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ABSTRACT

Although research on the microblade tradition in China dates back more than fifty years, there are still questions of classification, regional sequences, and chronology to be solved. The relevant archaeological data from China are summarized and the chronological sequences of the microblade tradition in different regions are analyzed. It is proposed that the time span of this tradition varied from region to region, and that it was associated with different non-microblade lithic assemblages in different areas. The florescence of the microblade tradition occurred close to the end of the Pleistocene, after which it declined in central China contemporary with the emergence of agriculture. The microblade tradition therefore serves as a technological correlate of the transition from Paleolithic to Neolithic in central China. KEYWORDS: China, microblade tradition, regional and chronological sequence, lithic tradition.